



CALIFORNIA ENERGY COMMISSION

Biomass-Based Alternative Transportation Fuels in California

**IEPR Workshop on Status of Bioenergy
Development in California**

June 3, 2014

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**Alternative and Renewable Fuel and Vehicle Technology
Program**



California Transportation: Nation-State Statistics

- Population: 37.7 million
- GDP: \$1.9 trillion - 9th largest global economy
- GHG Emissions: 440 MMT (2004)
 - 7.2% of U.S. Emissions (Pew Center)
 - 10th largest emitter on global scale
 - **Transportation accounts for 42 % of all GHG emissions**
- Vehicles: 26.5 million cars + 0.92 million trucks
- Annual Fuel Consumption: 18.8 billion gallons
 - 15 billion gallons gasoline
 - Includes about 1.5 billion ethanol as E10 blendstock
 - 3.3 billion gallons diesel



Current Commercial Biofuels in California

Ethanol

In-State Supply

Capacity: 241 MGY (5 plants)

Production: 170 MGY

Primary Feedstock: Midwest Corn

Total Demand: 1.5 billion gallons per year

Biodiesel

In-State Supply

Capacity: 46 MGY (12 plants)

Production: 26 MGY

Primary Feedstocks: Midwest soy, waste grease

Imports: 100 MGY (Neste Renewable Diesel)

Total Demand: 126 MGY



Alternative and Renewable Fuel and Vehicle Technology Program (AB118)

Purpose

To transform California's transportation market into a diverse collection of alternative fuels and technologies and reduce California's dependence on petroleum.

“...develop and deploy innovative technologies that transform California’s fuel and vehicle types to help attain the state’s climate change policies.” (Health and Safety Code Section 44272(a))

Up to \$140 Million in Annual State Funding Program

The Energy Commission will receive **\$100 million/year for 7 years** to implement the ARFVT Program: Fuel production, Infrastructure, Trucks

California Air Resources Board will receive **\$40 million/year for over 7 years** for *Enhanced Fleet Modernization and Air Quality Improvement*: Light Duty Vehicle, Buses and Trucks.



California's Policy Goals and Objectives

Policy Objectives	Goals and Milestones
GHG Reduction	Reduce GHG emissions to 1990 levels by 2020 and 80% below 1990 levels by 2050
Petroleum Reduction	Reduce petroleum fuel use to 15% below 2003 levels by 2020
In-State Biofuels Production	Produce in California 20% of biofuels used in state by 2010, 40% by 2020, and 75% by 2050
Low Carbon Fuel Standard	10% reduction in carbon intensity of transportation fuels in California by 2020
RFS2	36 Billion Gallons of renewable fuel by 2022
Air Quality	80% reduction in NOx by 2023
ZEV Mandate	Accommodate 1 M EVs by 2020 and 1.5 M by 2025



Sustainability and AB 118

- “A rapid transition to alternative fuels has the potential to encourage environmentally destructive production practices
- We have developed sustainability goals and criteria for AB 118, and will consider sustainability in every funding decision we make”

Energy Commissioner

Karen Douglas

– January, 2009





Funding Summary: 2009-2013

(Cumulative NOPAs Through April 2013)

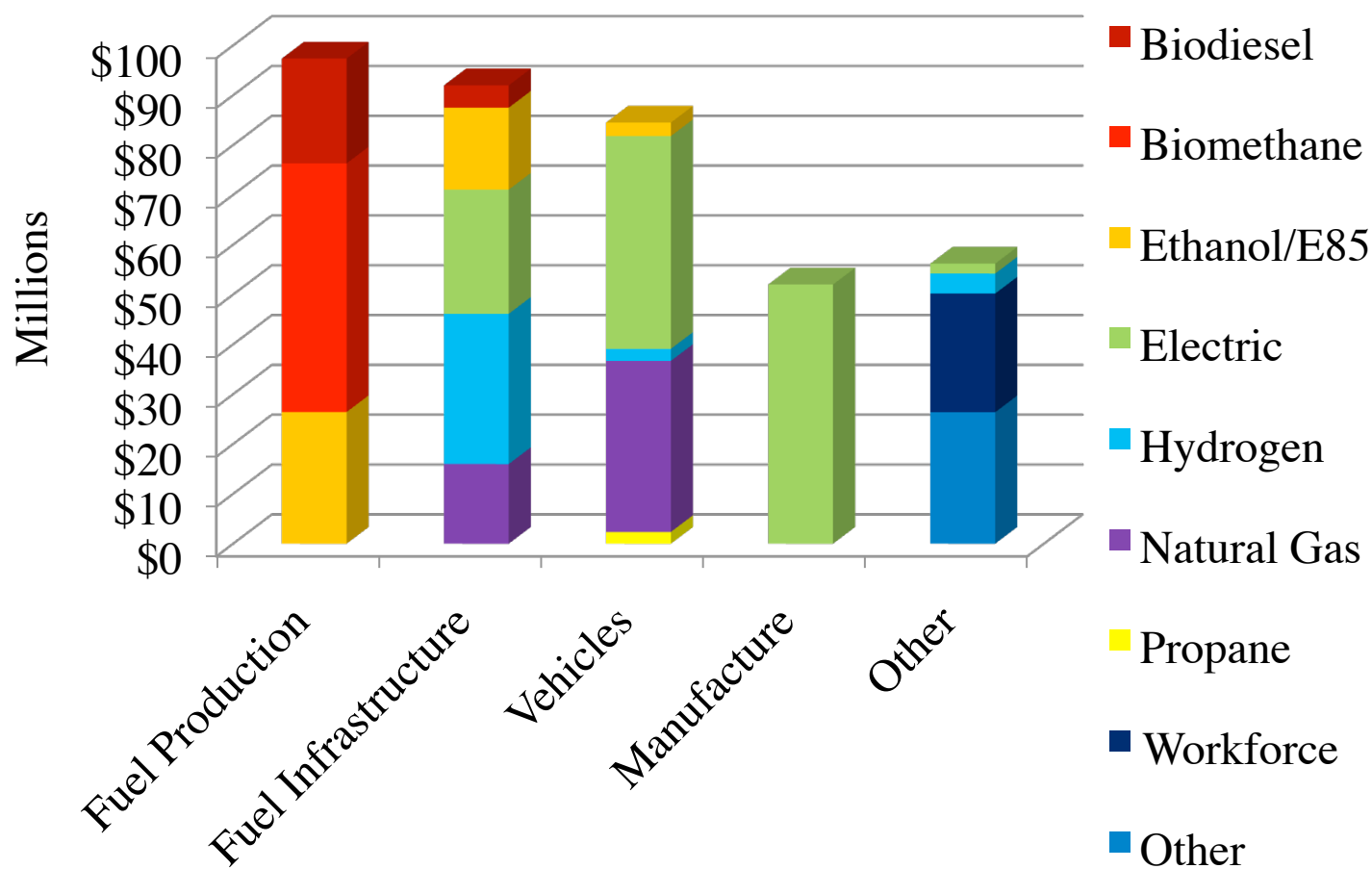
2009 – 2013 Alternative Vehicle, Fuel & Infrastructure Investments			
Investment Areas	Funding Amount (\$ millions)	Percent of Total (%)	Number of Awards
Electric Drive	121.65	31	81
Biofuels	123.10	31	46
Natural Gas	52.68	14	55
Hydrogen	43.25	11	10
Workforce Development	23.83	06	30
Market and Program Development	26.29	07	17
Total	390.80	100	239

Each Private Sector Grant Requires Minimum 50% Private Capital Match ⁷



Agreements in Progress

2009-13 Cumulative Funding through NOPA Phase - \$390 million





Biofuels Investment Strategic Goals

1. Move California away from initial investments in first generation corn- and soy-based biofuels
2. Build capacity of California firms to produce second and third generation biofuels using advanced process technologies and waste-based and alternative feedstocks
3. Leverage knowledge, technologies and feedstocks from current biofuel production base

UC Davis California Biomass Collaborative Report:

California waste-based feedstock potential for 2.7 to 3.1 billion gallons of fuel per year



Waste-Based Feedstock Volumes and Fuel Production Potential

Feedstock	Volume Technically Available	Biomethane Potential (BCF)	Biofuel Potential (million gge)	DGE Potential (million)
Agricultural Residue	4.3 MBDT	9.3	302	261
Animal Manure	3.8 MBDT	14.6	127	110
FOG	14.4 M lbs	Unknown	63.6	55
Food Wastes	0.8 MBDT	1.9	56	48
Forest Biomass Waste (via cellulosic ethanol)	14.2 MBDT	N/A	784	678
Forest Biomass Waste (via gasification)	14.2 MBDT	30.7	1000	864
Landfill Gas	79 BCF	39.5	368	318
Municipal Solid Waste	10 MBDT	25.9	704	608
Waste Water Treatment Plants	9.6 BCF	4.8	45	39
Total		126	2,566	1,755



Biofuels Funding

Category	Funding (\$millions)	No. of Projects
Fuel Production		
Biogas	49.9	13
Biodiesel / Renewable Diesel	21.0	11
Ethanol	20.4	7
CEPIP	6.0	3
Total Fuel Production	97.3	34
Fueling Infrastructure		
Biodiesel Tankage	4.4	5
E85 Retail Stations	16.4	205
Total Infrastructure	20.8	210



Biofuels Going Forward

Ethanol

- High feedstock costs
- Limits to arable land and feedstock availability
- Cellulosic technology not at commercial scale in California
- Difficult to compete at scale with Midwest Corn and Brazilian Sugarcane
- E85 sales relatively flat
- Need carbon markets to recognize low carbon values of California products
- Need cellulosic and drop in fuels to compete commercially
- Mendota Beet Project example of promising future approach



Biofuels Going Forward

Biodiesel – Renewable Diesel

- California producers aggressive in bringing new production on line
 - Expanding production at existing plants
 - 3 commercial plant awards through ARFVTP
 - May expand as regional niche markets and producers
- Carbon markets recognizing value of low CI biodiesel from waste greases
 - 11 to 17 gCO₂e/MJ
- Transitioning away from soy as primary feedstock
 - Oil palm feedstock controversies
- Low cost alternative fuel option for truck sector



Biofuels Going Forward

Biodiesel – Renewable Diesel

- Algal-based fuels show promise
- Neste Oil Renewable Diesel from Singapore
 - 100MGY from waste tallow from Australia / New Zealand
 - “game changer”
- Emerging markets for aviation and off-road construction sectors



Biofuels Going Forward

Biogas

- Current production low and expensive
 - No access to pipeline distribution
 - “tethered fleets”
- Very strong future market potential due to low CI values and emerging markets
 - Biogas RNG: 11 to 13 gCO₂e/mj
 - High Solid Anaerobic Digestion of organics: -15 gCO₂e/mj
- Need mature carbon markets and resolution of gas quality issues via AB 1900
- Current ARFVTP Funding
 - 9 commercial plants



Biogas Market Opportunities in Transportation Sector

California's Truck Fleet = Nearly 1 Million Vehicles

- 4 percent of total vehicle population
- 16 percent of petroleum consumption & GHG emissions
- Major contributor of criteria emissions and PM in urban air basis
- Low NOx engines and RNG can meet future emission standards for carbon and criteria emissions

Conversion to Natural Gas Well Underway

- Compliance option for meeting diesel emissions regulations
- About 15,000 trucks on road in California
 - CEC funding added 1,500 trucks
- 460 natural gas fueling stations in California
- Clean Energy Natural Gas / RNG stations and products

California's Transit Bus Fleet



Biogas Market Opportunities in Transportation Sector

Renewable Hydrogen for Fuel Cell Vehicles

- FCV light duty vehicle population projected to increase from 250 to 50,000 units by 2017
- Publicly-funded hydrogen fueling stations must have one third renewable hydrogen component (SB 1505)

Process Fuel Replacement for Biorefineries

- 5 ethanol biorefineries
- 12 biodiesel biorefineries
- Federal Renewable Fuel Standard and State Low Carbon Fuel Standard will drive expansion of biorefineries



Additional CEC Information

DRIVE Website

<http://www.energy.ca.gov/drive/>

Alternative and Renewable Fuel and Vehicle Technologies Program:

FY 2013-14 Investment Plan

<http://www.energy.ca.gov/2011-ALT-1/documents/index.html>